REMARKS

Reconsideration of this application is requested.

The applicants thank the Examiner for the indication that claims 9, 10, 24 and 25 contain allowable subject matter if rewritten as independent claims. At the present time, the applicants traverse the rejections and therefore, decline to presently resubmit the claims in independent form, but reserve the right to do so at a later date.

Claim 1 was objected to because a comma was omitted between "vinyl ethylene carbonate" and "vinyl quinone". A comma has been inserted at line 10 in accordance with the Examiner's suggestion. Accordingly, it is suggested that the Examiner's objection of this claim should be withdrawn.

Claim 24 was objected to before the correction to claim 1, the Examiner was of the opinion that claim 24 broadens the scope of the claims. It is submitted that amended claim 24 narrows the scope of the claims and it appropriate. Accordingly, the Examiner is requested to withdraw the objection to claim 24.

Claims 1-32 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the aspects of the invention. Specifically, the Examiner stated that claim 1 requires the use of a gas suppressing additive but in the Examiner's opinion, the specification is unclear as to the identity thereof. The Examiner is referred to page 2, second paragraph thereof, as well as to the paragraph bridging pages 2 and 3. Accordingly, it is suggested that as stated, the materials indicated not only passivate but also prevent gasing and therefore, it is believed that the specification adequately discloses gas suppressing additives and their identity and the Examiner is requested to

withdraw the rejection under §112.

Claim 12 was rejected under 35 U.S.C. §112, first paragraph, because according to the Examiner, the specification did not provide enablement for monofluoroethylene. Claim 25 was rejected similarly for failure to provide enablement for derivatives of vinyl crotonate and claim 27 was rejected for failing to enable vinylimidazole. Because the originally filed claims are part of the specification, additions have been made to page 3, lines 1-7 to provide basis for these claims, whereby these rejections should be withdrawn.

Claims 2-26 and 28 were rejected under 35 U.S.C. §112, second paragraph, as failing to use the term "an". The claims have been amended to refer to "an" additive. Because the additives are identified in the application to both passivate an electrode and also to prevent gasing to extend the cycle life of the battery and assist in improving the safety of the battery or cell, it is suggested that the amendments render these claims patentable within the requirements of §112.

Claim 27 was again rejected under 35 U.S.C. . §112, second paragraph, in the use of the term "vinylimidazole, but it is believed that this rejection should be withdrawn.

Claim 27 was rejected under 35 U.S.C. §112, second paragraph, as being indefinite in the use of the term "said compound". This matter has been corrected.

All of the claims have been rejected under 35 U.S.C. §103(a), over various combinations of the Olsen et al. U.S. Patent No. 5,455,127, the Kotado et al. Japanese patent no. JP 2001-006729, the Gan et al. U.S. patent no. 6,068,950, and the Sekino et al. U.S. Pub. 2002/0164531.

All rejections under 35 U.S.C. §103 are traversed. In the present application, the invention clearly show that using an organic phosphate such as triphenyl phosphate (TPP) alone has very little impact on the safety at high temperature or on gas suppression during Li-ion battery overcharge and cell abuse. The same is true with vinyl ethylene carbonate (VEC) alone. Little impact on cell safety during abuse at high temperature was observed in their experiments. By considering these data, what is obvious to one skilled in the art is that by blending these two additives that have little impact on safety at high temperature, no real significant improvement on cell safety during cell abuse at high temperature would be expected. However, the results of the blended additives show that there is a significant impact on cell safety, see Fig 2C, and the explanation thereof on page 7. In this case, the onset temperature of reaction increased from 150°C (case of VEC, Fig 2A) and 180°C (case of TPP, Fig 2B) to 210°C for the blend. Also, the heat generated from the cell during cell abuse at high temperature was reduced significantly (by an order of magnitude) when compared to using each additive alone. Therefore, the inventors believe that this significant improvement in the safety of the cell by adding a blend of two additives that didn't markedly affect the cell thermal safety when used alone is not at all obvious to one skilled in the art.

The Gan '950 patent on the use of organic phosphate additives to avoid voltage delays in cell operation does not relate to the safety of the Li-ion battery during overcharge and contains no references to the vinyl ethylene carbonate (VEC). It is clear from the gassing data in Table I of the present application and the arc data of Fig.

2B of this patent application that triphenyl phosphate, a typical additive, cited by Gan is not very effective as a safety additive at the elevated temperatures that are encountered during battery overcharge and abuse. This simply means that the passivation film formed on the surface of the anode by the additives at room temperature is unstable at the elevated temperatures encountered during battery overcharge and abuse. This suggests that this passivation film is probably partially dissolved in the electrolyte, since the gassing characteristics of battery are still very high.

The Kotado Japanese patent clearly indicates as the patent examiner suggested that vinyl ethylene carbonate is effective in stabilizing the anode in the presences of propylene carbonate and other organic carbonate based electrolytes at room temperature. However, the inventors' experiments show (Table I) the gassing characteristics during the Li-ion battery overcharge seems to be effected very little by the presence of a 5 w/o additive of vinyl ethylene carbonate. Moreover, the Arc data (Fig. 2-A) shows that this additive has the worse performance at elevated temperature during cell abuse. The onset temperature of reaction is very low which means that the cell stability is lost in the very early stages of the abuse process.. Again, suggesting that during over charge and cell abuse at high temperature, the elevated temperature causes the passivation film on the anode to breakdown probably by dissolution in the electrolyte. The VEC additive is well known to form a passivation film at the carbon anode to improve the cycling performance of the cell at room temperature; however, this passivation film tends to breakdowns at temperatures higher than 60°C.

Therefore, when one blends organic phosphates and vinyl ethylene carbonate, see Table I of the present patent application and (Fig 2-C), it is not at all obvious that one-skilled-in-the-art would predict that the free radicals formed by the vinyl ethylene carbonate would interact with the organic phosphates significantly to reduce the battery gas generation by an order of magnitude and improve the abuse tolerance of the cell at high temperature by an order of magnitude. This result is unexpected and cannot be said to be obvious to one of ordinary skill in the art.

Cell gassing and heat generation are both critical items that need to be addressed in developing improved battery safety. In both of these critical areas the proposed blend of additives in Table I and Fig 2-C of the present application shows marked improvement over any single additive. A scientist of ordinary skill in this art who looks at the effect of the single additives would predict that a blend of the additives would probably result in a cell volume change of 16 % and not the 2.9 % observed. Another factor in support of this invention is the fact that there are no references on the effect of the proposed additive blends as it relate to Li-ion battery gassing and safety. During Li-ion battery overcharge, it is quite obvious from the inventors' experiments that one could not predict how the blend of additives will function knowing how the respective individual additives function. It is important for the Examiner to understand that it is entirely possible to improve the stability and cycle life of a Li-ion battery at room temperature through the use of an additive that prevents surface reaction that can cause power and capacity fade. However, these same additives may not be effective at higher temperatures because the passivation films formed by them breakdown, it has

been shown time and time again in efforts at Argonne National Laboratory, to stabilize various Li-ion battery couples at elevated temperatures.

If the Examiner were correct in her opinion that the blend of the proposed additives is obvious to any one skilled in art how does she explain the following points: (1) Why are the blends so much more effective then predicted by the additive effect of the individual additives, (2) Cell stability studies carried out at room temperature can not be extrapolated successfully to the elevated temperatures observed during Li-ion battery overcharge and abuse. (3) Stabilizing the graphite anode at room temperature by the use of a vinyl ethylene carbonate or an organic phosphate additive says little or nothing about how the additive might work during Li-ion battery overcharge and abuse, see Table I and Fig 2-A

The Examiner has engaged in long prohibited hindsight reconstruction of the prior art using the present invention as a template, *In re Fine*, 5 U.S.P.Q. 1596 (Fed. Cir. 1988). The mere existence of references which teach the existence of different additives is insufficient on which to base an obviousness rejection, unless there is a suggestion in the art to make the claimed combination, *In re Ochiai*, 37 U.S.P.Q. 2d 1127 (Fed. Cir. 1995). Moreover, the substantially improved results stated above clearly renders the claimed combination patentable, *In re Soni*, 34 U.S.P.Q. 1684 (Fed. Cir. 1995).

None of the other references relied upon by the Examiner, such as the Olsen et al. U.S. patent no. 5,455,127 or the McMillan et al. U.S. patent no. 6,506,524 show the

combination of materials as set forth and required by the invention as claimed, nor in any reference cited by the Examiner that would remotely show the order of magnitude improvement obtained by the combination of materials taught in the present application.

For all the foregoing reasons, it is respectfully suggested with the exception of claims1-28 and each and every claim is believed to be drawn to patentable subject matter and the allowance thereof is requested.

All matters having been addressed, this application is believed to be allowable and the Examiner is requested to pass this application and each claim therein to issue.

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Respectfully submitted,

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